PRELIMINARY MAPPING OF LAVA FLOWS AND GRABEN SYSTEMS ASSOCIATED WITH THEIA MONS, BETA REGIO, VENUS. A. Shimolina[1], R.E. Ernst[1,2], H. El Bilali[1,2], E.G. Antropova[2], C. H. G. Braga[2]. [1]Faculty of Geology and Geography, Tomsk State University, Tomsk, Russia; arina051299@gmail.com, [2]Department of Earth Sciences, Carleton University, Ottawa, Canada

Introduction: Theia Mons is one of the most important volcanic edifices on Venus (Figs. 1 and 2). It is centered at 22.7º N, 281.0º E (101.0º W) on Beta Regio, which along with Atla and Themis Regio, define the BAT (Beta-Atla-Themis region) as the youngest volcanic and tectonic activity of Venus. Beta Regio is thought to represent a currently active plume in that it is topographically elevated, has an associated geoid high, is the center of a triple junction rifting system [1] and is also the focus of a giant radiating dyke swarm [2].

The northern half of Theia Mons has been mapped at 1:5,000,000 scale as part of Beta Regio Quadrangle (V–17) [3]. The southern half of Theia Mons is located in Devana Chasma Quadrangle (V-29), and initial 1:5,000,000 mapping of this quadrangle was reported in [4]. The global compilation of [5] catalogued this as Theodora Patera (24.0º N 280.5º E) with a diameter of 1,000 km [5]. In later publications [1,3] it is referred to as Theia Mons and we use this name here.

General view and objectives: Theia Mons consists of a volcanic edifice which is 500 km across and 2.5-3 km high with a deep central caldera (2.5 km deep) which is about 50 km across (Fig. 2). Flows can be traced up to at least 650 km away from the central edifice. The radiating dyke swarm (recognized by their surface expression as grabens) can be linked to a regional linear N-S swarm suggesting an overall swarm length of 3,400 km (Fig. 1, [2]). The transition in the dyke swarm pattern from the radiating to linear pattern at 1,000 km is interpreted to mark the outer boundary of the underlying flattened plume head [6].

The focus of this research is detailed mapping of Theia Mons at a scale of 1:500,000 with the following goals: 1) identify the sources of all mapped flow units, 2) integrate the emplacement of flows with graben system (dyke swarm) emplacement and central caldera collapse (above a central magma reservoir); 3) characterize the relationship with the triple junction rifting; and 4) develop a comprehensive geological history of Theia Mons in order to better constrain the geodynamic evolution of Beta Regio plume event.

Lava flow mapping: Initial mapping of flows and grabens in the NE quadrant (Fig. 3) indicate multiple generations and suggest rifting postdates emplacement of flows. We suggest two different directions of flows (Fig. 4): from the central caldera (red arrows) and from the grabens to the north of it (yellow arrows). Alternatively, the northern flows (yellow arrows) could also be from a source further southwest that is obscured by the younger set of grabens. An important question to be addressed from continued mapping is whether this NE set of grabens is underlain by dykes or whether these grabens are purely due to extension in a rift zone.

Graben systems mapping: Mapped graben systems trend in different directions (Fig. 5). One radiating graben system is focussed on Theia Mons, and five other graben systems trend past Theia Mons and likely belong to other magmatic centres outside the study area.

Theia Mons caldera is about 50 km across and 3,5 deep, and we estimate that caldera collapse would be associated with about 5000 km^3 of magma expelled as dyke swarms and/or lava flows. On the north side, the radiating swarm transition to a linear swarm parallel to Devana Chasma (Fig. 1); detailed mapping in progress is testing for a similar transition on the southern side.

Five additional trends of grabens (dykes) probably belong to other centres outside study area.

Acknowledgments: Magellan SAR images obtained from https://astrogeology.usgs.gov/search/?pmi-target=venus based on the data from https://pdsimaging.jpl.nasa.gov/volumes/magellan.html#mgnFMAP.

References: [1] Basilevsky A. and Head J. W. (2008) *Icarus*, 192, 167–186. [2] Ernst R. E. et al. (2003) *Icarus*, 164, 282–316. [3] Basilevsky A. (2008) *U.S. Geological Survey Scientific Investigations Map* 3023. [4] Tandberg E. R. and Bleamaster L. F. (2010) *LPS XLI*, Abstract #1816. [5] Crumpler L. S. & Aubele J. C. (2000) *In Sigurdsson, H. (ed.), Encyclopedia of Volcanoes. Academic Press*, 727–769. [6] Ernst R. E. and Buchan K. L. (2001). *Geological Society of America*. Special Paper 352, 247–265.

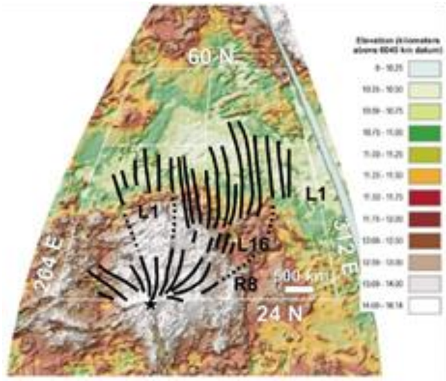

Figure 1 *– Topographic map of Beta Regio showing elevated topography centered on Theia Mons (star) and associated with potential radiating swarms that swings into a common trend after 1,000 km (modified after [2]).*

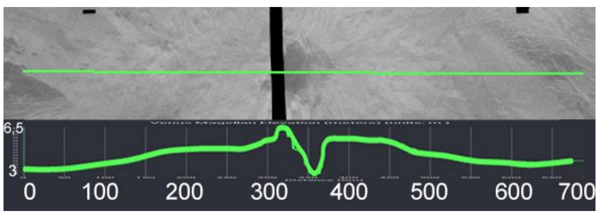

Figure 2 *– W-E topographic profile across Theia Mons reveals an edifice 500 km across with a deep central caldera which is about 50 km across. Flows can be traced up to at least 650 km away from the central edifice. The SAR image of Theia Mons is 750 km across. Vertical exaggeration 15x.*

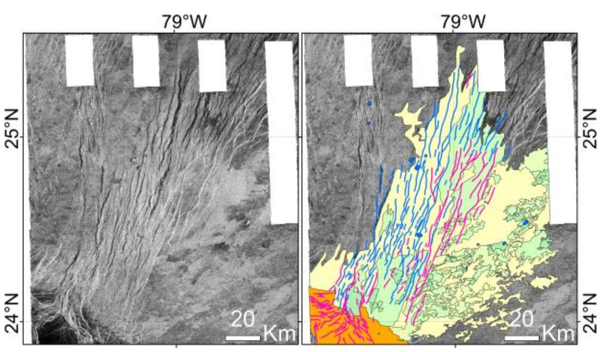

Figure 3 *– Initial mapping of flow units. Different polygon colors correspond to: orange – caldera, yellow to green – separated flows, blue – pits. Different line colors correspond to: blue – radar dark side of grabens, pink – radar bright side of grabens, corresponding to left and right sides of grabens in Cycle 1 left looking Magellan SAR images.*

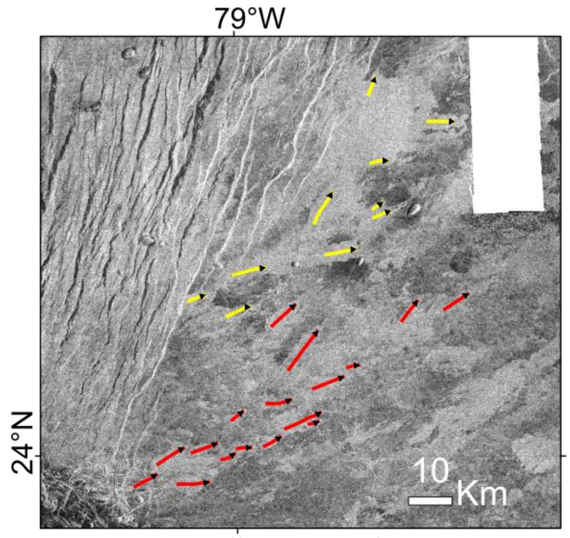

Figure 4 *– Two different sets of Theia Mons' north-east flows: red arrows – flows from caldera, yellow arrows – flows from grabens or from source further SW but obscured by the grabens.*

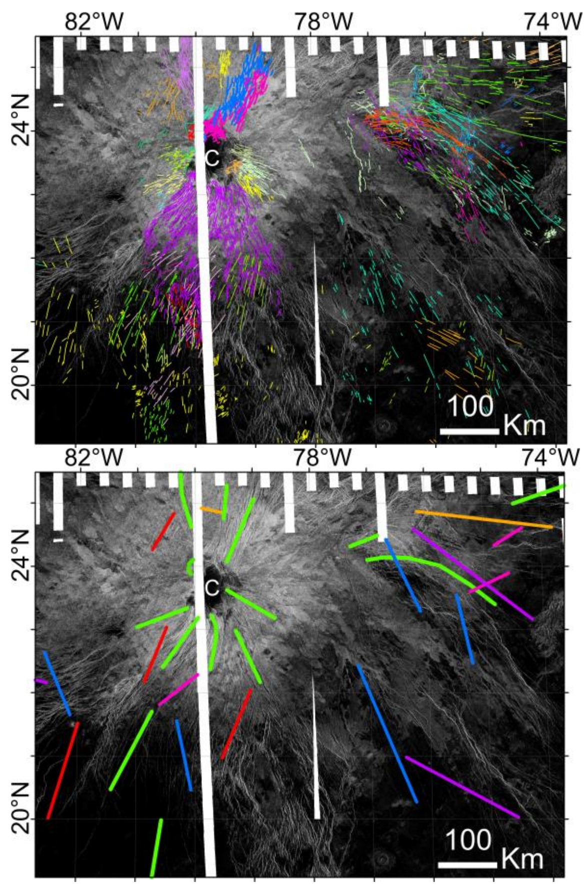

Figure 5 *– Mapping of grabens in vicinity of Theia Mons, coloured by swarm. Green belongs to Theia Mons radiating swarm. C marks caldera. Upper Image: detailed mapping at 1:500,000. Lower Image: generalized graben distributions.*